

GEORGE ENGELMANN BOTANICAL NOTEBOOKS

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4 formerly confounded with others, and first clearly established by Durieu L. C. C. G. Pringle. — This is the original Linncean species. ^{It is} It is always readily recognized by its rigid rather thick not gradually tapering dark green leaves, which do not collapse when taken out of the water, and by the size and sculpture of the spores. The variety paupera is based on western mountain specimens and is characterized by the smaller proportions of all parts and especially of the, for the species, unusually small microspores. Durieu in Bull. L. C. 11 p. 101 distinguished a form with exceptionally large macrospores (0.70 to 0.80 mm diam.) as I. macrospora from a single specimen from the Herb. Acad. N. S. Philad., with the label "Catskill Mountains" in the handwriting of Schweinitz, ~~In the same Herbarium~~ is a specimen complete counterpart of this specimen, with the label "Bethlehem" and a third one in the Imperial Museum at St Petersburg. All three most probably come from Schweinitz and from the Catskill Mountains and where the species has not been found since who lived in Bethlehem, but all have not the very large spores but others show sometimes spores of similar dimensions, e.g. specimens from Lake Superior, and such have also been found in Europe, though there the spores rarely reach a size of over 0.65 to 0.70. ^{mm} ~~in diameter~~

2. I. pygmaea Engelm. One of the smallest species with few (5 to 10) short ($\frac{1}{2}$ to 1 inch long) stout, rigid, bright green leaves, abruptly tapering to a fine point, with very short, often almost square epidermis cells, orbicular sporangium (with a narrow columella, not spotted) macrospores 0.36 to 0.50 mm thick, marked with minute rather regular,



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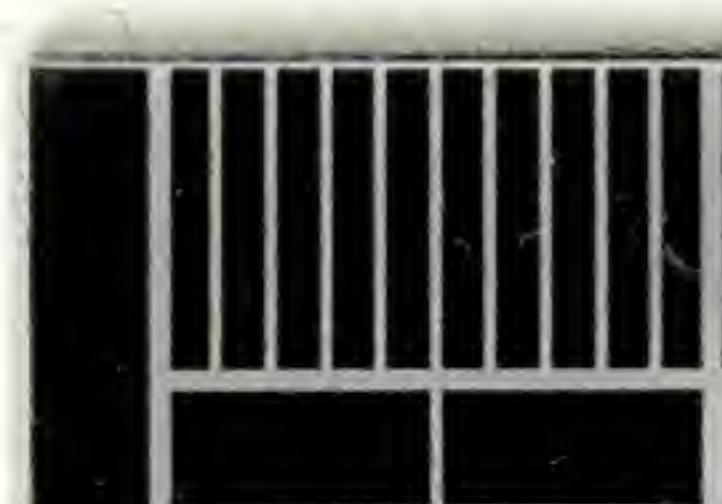
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Distinct or rarely confluent, warts; microspores 0.024 to 0.029 mm.
long, almost smooth. ^{brown} Am. Naturalist 8. 214

Found only once, ^{deeply immersed} via cold alpine stream on the eastern slope of the California

Mono pass, > 7000 ft alt. H. Bolander. — This curious diminutive species is a close ally to the last by ~~which~~ it has the structure of the leaves and the mode of living but is widely separated from it by the sculpture of the spores; the shortness of the epidermis cells is quite peculiar to it and so are the close transverse partitions; the walls of the leaf and the dissepiments are thinner than in the last, consisting of only a few layers of cells. The minute tubercles of the macrospores are most distinct on the lower surface, but become sometimes confluent on the upper side.

3. I. Tuckermani, A. Braun in litt. A small plant with very slender tapering olive green leaves (10 to 30 in number, mostly 2 to 3 inches long) the outer scoured, walls and partitions rather thick for the diameter of the leaf; sporangium mostly oblong, white or rarely brown-spotted, the upper third covered by the velum; macrospores 0.44 to 0.56 mm. diam. the upper segments marked with prominent, somewhat parallel and branching ridges, the lower half reticulated; microspores smooth or nearly so, 0.026 to 0.032 mm long. — Luzel in Gray Man. c. 676.

In several ponds and streams near Boston, maturing from August to October; first discovered by E. Tuckerman ¹⁸⁴⁸ in the Mystic River very near where it issues from the pond; in the same locality and ⁱⁿ Mystic, Spy and Horn



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ponds, W. Booth, ¹¹ in shallow water, sometimes only a few inches below the surface, but always immersed, ~~but often~~ ^{but often} generally in places which are subject to a tide of sometimes two feet in height, ~~but in fresh water~~, generally gregarious and carpeting the bottom with an olive green "turf". The leaves are usually not longer than 2 or 3 inches, and, at least the outer ones, revolved; occasionally, in slender specimens, probably from deep water, I have seen them straighter and over 5 inches long.

The sculpture of the spores is very characteristic, wavy, somewhat branching ridges run from the 3 upper commissures in right angles; on the lower surface they interlace, covering it with an irregular network. — Some specimens collected by Mr. Booth at the end of October seem to indicate a second growth as within the circle of microspore-bearing leaves and after the outer ones with their microsporangia had fallen, an inner growth of ^{bearing} macrosporangia was noticed. — One of his specimens is of particular morphological interest as it shows four heads or leaf buds from the same healthy and vigorous trunk, ^{three} close together on top and a fourth on the side, separated by a deep incision in the trunk from the others. This division of the axis did not result from any proliferation of the leaves but most probably from a lesion of the center of vegetation, and is of very rare occurrence in this genus, where the simplicity of the axis is so particularly marked (see above p. 358).



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L. echinospora, Durieu. One of the smaller species with 10 to 30 or 40 soft bright green or sometimes reddish leaves, gradually and regularly tapering from a thick base to a very slender elongated tip point, $\frac{1}{2}$ to 4 or sometimes 5 inches long; sporangia ^{obscurely} circular to broadly oval, unspotted, with a narrow velum; macrospores 0.40 to 0.50 mm thick, densely covered with delicate, erect, truncate or slightly pointed spinules; microspores 0.030 to 0.034 mm long, almost smooth. — Bull. Bot. Soc. Fr. 8. 164

Only in Europe, from northern Italy to Germany France and England, and extending to Lapland
 also in Scandinavia and Iceland, but apparently not in America. ~~Here we have joined with this European type a series of American forms, considered~~
 distinct by eminent authority, because the only essential difference which I can find consists in the presence of stomata, few or many, and a slight difference in the (microscopic) spinules of the spores. But it must remain a matter of doubt, or I should better say, of individual judgment, whether they ought to be ~~considered distinct thus united or be kept separate.~~
 kept

~~in this country~~
 Here we have a series of forms which have been distinguished by eminent authority, especially on account of the presence of stomata and of a slight difference in the form and size of the microscopic spinules which cover the macrospores. I have thought best to unite them ^{though it seems strange that in the European plant stomata should be absolutely absent} with the European type ^{and it must remain subject} and it must remain subject



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~~xx Stomata sparsely few, and only near the tip of the leaf.~~

Spotted types

to individual judgment if not doubt, which view ought to be preferred. Nearest to the European true I. echinospora stands the var. Braunii and the other extreme is var. muellerata, wide ranging forms of a single type. The same difficulties, the same doubts, and the same solution we find in studying some foreign forms and especially those allied to I. velata of the South of Europe.

small type ~~xx Stomata few.~~

I. echinospora var. Braunii, Engelm. ^{rather} small, with 15 to 13 green or reddish-

green erect or spreading rather short (3 to 6 inches long) tapering siphonous leaves, generally with few stomata towards the tip only; sporangia orbicular to broadly elliptical, spotted, generally $\frac{1}{2}$ or even $\frac{3}{4}$ covered by a broad velum; macrospores 0.40 to 0.50 mm thick, rarely a little larger, covered with broad retuse sometimes somewhat confluent and then dentate or incised spinules; microspores 0.026 to 0.030 mm long, smooth. — Gray. Man. L. C. ^{I. Braunii} I. Duria L. C. ^{11. p. 101}

The most common species of our flora, from New Jersey and Pennsylvania northward and northwestward, sometimes on gravelly soil at other places reported from soft mud, in ponds or slow running streams, ^{also} ~~rarely~~ near the banks of larger lakes or under the influence of tide water, normally submerged from a few inches to several feet, in dry seasons sometimes getting out of water. It is found associated with Eriocaulon septangulare, Lobelia dortmanna, Sparganium, Sorpus, Eleocharis, etc. In New Jersey:



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in tide water of Tom's River, a slender long leaved form, C. F. Parker, C. E. Smith and others, in a lake in Morris County, J. C. Porter, Pennsylvania: Montrose, Susquehanna Co., A. P. Garber; Great Lake, Pocono & Mountain, Porter & Canby Presque Isle, Erie, A. P. Garber. New York: Catskill Mountains in the lake near the hotel G. W. Clinton; Round Lake above Bolton, west of Lake George, on white sand, and in Lake Placid, d. desqueux; Luzern Lake, G. W. Clinton (and in Niagara River below Buffalo), ^{between stones}; at the head of Goat Island, Niagara, G. Engelmann; Meida Lake, J. A. Paine; in Oswego River J. Parish, probably, see pag 353; Massachusetts: Mystic Pond, gregarious in soft mud, near the lower end of the pond, in 1 foot of water, also in other parts of the same pond, in ^{spot} spot, Spy and Horn Ponds on sandy bottom, all near Boston, W. Booth, Hammond's Pond, W. G. Farlow; Concord Brook, gregarious on firm bottom, H. Mann. Beaver Pond near Beverly J. L. Russell, Uxbridge in Grafton Pond and several other ponds, J. W. Robbins. Vermont; Mount Mansfield, in the Lake of the Clouds, C. G. Pringle, H. Mann, on gravelly bottoms, 1 to 2 feet deep; Lake Dunmore, A. W. Chapman. New Hampshire, Lake Winnipesaukee, ^{Minneiwesaukee} in mud with Gratiola aurea, Eriocaulon etc G. Engelmann (these specimens were the type of Guriella J. Braunii), H. Mann, W. Booth; Echolake in the Franconia Mountains (where Mr Tuckerman and myself had found J. carolinianus) W. Booth. Maine: Moose Lake



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on Kennebunk River, C. E. Smith, Nova Scotia, Shelburne T. P. James, Greenland, in the south, "Tessermint" I. Vahl (but perhaps this is the true I. echinospora; I could not ^{well} analyze the small and poor specimen in my possession). Westward the species has been found in Western Canada (Ontario) near Hastings and in a lake northeast of Belleville, on a muddy bottom in J. Macoun; Michigan: Belle Isle in Detroit River, H. Gillman, Mich. : Lake at the head of Bear River in the Kintah Mountains at 9500 feet alt. I. Watson: this is the most western and highest, quite isolated locality, known to me.

This form is most closely connected with the European type; the leaves are perhaps not quite so finely tapering, stomata can always be found, at least near the tip of the leaf; the spongia, ^{white in the type,} are spotted with brown sclerenchym cells; the macrospores I can not distinguish either in size or sculpture; the microspores I find a little smaller. I may state here that the name of I. Braunii is preoccupied, as it has already been given to one of the two tertiary species of the tertiary deposits, the well marked spores of which have been discovered in the German Brown Coal strata; Prof Braun therefore proposed ~~for~~ that it should eventually be considered distinct, the name of I. ambigua.

Var. robusta, ^{Engelm.} Similar to the last, but much stouter, with 25 to 70 leaves, 5 to 8 inches long, with abundant stomata all over their



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surface; velum covering about one half of the large, spotted sporangium; macrospores 0.36 to 0.55 mm thick, with the sulphur of the last; microspores the same as in last.

In Lake Champlain on the north end of Isle La Motte, on a firm sandy soil with silt, in 1 to 2 feet of water. *C. G. Pringle*, larger and stouter than any form of the last but principally distinguished from it by the abundance of stomata.

Var. Boottii, Engelm. l. c. Leaves erect, soft, bright green, few (12 to 20) short (4 to 5 inches long), stomata mostly few, near the tip; sporangia nearly orbicular, pale-spotted, $\frac{2}{3}$ or more covered by the broad velum; macrospores 0.39 to 0.50 mm thick with longer and slenderer, ^{delicate} generally simple delicate spinules; microspores 0.026 to 0.030 mm. long. — *I. Boottii*, Durieu in ^{lett.} *Botan. Journ. de France*.

Near Boston, Wm. Boott, in the Round Pond, Woburn 2 to 3 feet under water and in the brook of Toft Swamp, at Lexington, sometimes out of water. — Very striking on account of the delicate green colour of its soft leaves and the long and slender spinules of the spores.

Var. muricata, Engelm. l. c. Leaves long, ^{(15 to 20) (6 to 12 inches)} pl acid, bright green ^(15 to 20) with very few stomata; sporangium broadly oval, pale-spotted, about half covered by the velum; macrospores a little larger, 0.40 to 0.58 mm thick, with shorter and more confluent, therefore ^{sometimes} almost crest-like spinules; microspores slightly rough on the edges, 0.028 to 0.032 mm long. — *I. muricata*, Durieu l. c.

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